

What is claimed is:

- 1 1. An expandable medical device comprising:
2 a plurality of elongated beams, the plurality of elongated beams joined
3 together to form a substantially cylindrical device which is expandable from a cylinder
4 having a first diameter to a cylinder having a second diameter, the plurality of
5 elongated beams each having a beam width in a circumferential direction; and
6 a plurality of ductile hinges connecting the plurality of beams together in
7 the substantially cylindrical device, the ductile hinges having a substantially constant
8 width in a circumferential dimension along a portion of a hinge length which is at least
9 $\frac{1}{3}$ a total hinge length, wherein the hinge width is smaller than the beam width such
10 that as the device is expanded from the first diameter to the second diameter the ductile
11 hinges experience plastic deformation while the beams are not plastically deformed.

- 1 2. The expandable medical device according to Claim 1, further comprising
2 an abrupt transition between each of the elongated beams and each of the ductile
3 hinges.

- 1 3. The expandable medical device according to Claim 1, further comprising
2 a plurality of axial slots between adjacent elongated beams and a plurality of
3 circumferential slots, wherein the plurality of ductile hinges are each formed between
4 an axial slot and a circumferential slot.

- 1 4. The expandable medical device according to Claim 3, wherein the
2 ductile hinges are formed at opposite ends of the circumferential slots.

1 5. The expandable medical device according to Claim 1, wherein the
2 ductile hinges are each in the shape of a curved prismatic beam.

1 6. The expandable medical device according to Claim 5, wherein the
2 curved prismatic beams are positioned such that during stent expansion, tensile strain is
3 distributed along a convex surface of the curved prismatic beam.

1 7. The expandable medical device according to Claim 1, wherein the
2 plurality of elongated beams are formed of wire and the plurality of ductile hinges are
3 reduced diameter portions of the wire.

1 8. The expandable medical device according to Claim 1, wherein expansion
2 of the substantially cylindrical device from the first diameter to the second diameter
3 which is at least two times the first diameter results in substantially no axial
4 contraction.

1 9. The expandable medical device according the Claim 1, further
2 comprising a geometric deflection limiting feature for limiting an amount of bending of
3 the ductile hinges.

1 10. The expandable medical device according to Claim 9, wherein the
2 geometric deflection limiting feature is a V-shaped notch having side surfaces which
3 contact each other when a maximum amount of bending is reached.

1 11. The expandable medical device according to Claim 1, wherein the
2 plurality of elongated beams extend substantially axially and a plurality of
3 circumferential beams are each connected at first and second ends to one of the axial
4 beams by a ductile hinge.

1 12. An expandable medical device comprising:
2 a cylindrical tube;
3 a plurality of axial slots formed in the cylindrical tube in a staggered
4 arrangement to define a network of elongated struts, wherein each of the elongated
5 struts are axially displaced from adjacent struts; and
9 a plurality of ductile hinges formed between the elongated struts, the
10 ductile hinges allowing the cylindrical tube to be expanded or compressed from a first
11 diameter to a second diameter by deformation of the ductile hinges, the ductile hinges
12 being asymmetrically configured to reach a predetermined strain level upon a first
13 percentage expansion and to reach the predetermined strain level upon a second
14 percentage of compression, wherein the first percentage is larger than the second
15 percentage.

1 13. The expandable medical device according to Claim 12, wherein the
2 elongated struts have a substantially constant width in a circumferential direction, and
3 the ductile hinges have a width in the circumferential direction which is less than 2/3
4 the width of the struts.

1 14. The expandable medical device according to Claim 13, wherein a
2 transition between the cross sectional area of the struts and the cross sectional area of
3 the ductile hinges is an abrupt transition which extends less than 10 percent of a length
4 of a strut.

1 15. The expandable medical device according to Claim 12, wherein the
2 plurality of ductile hinges are curved prismatic beams having a convex side surface and
3 a concave side surface.

1 16. The expandable medical device according to Claim 12, wherein a ratio
2 of a length of the ductile hinges to a length of the axial struts is 1:6 or less.

1 17. The expandable medical device according to Claim 12, further
2 comprising a geometric deflection limiting feature for limiting an amount of bending of
3 the ductile hinges.

1 18. The expandable medical device according to Claim 12, wherein the
2 ductile hinges are designed to deform plastically upon radial expansion or compression
3 of the expandable medical device while the elongated struts experience no plastic
4 deformation upon radial expansion or compression.

1 19. The expandable medical device according to Claim 12, wherein the
2 expandable medical device is formed of Nitinol, and the ductile hinges are designed to
3 deform upon radial expansion or compression of the expandable medical device and can
4 be returned to an original configuration by heating.

1 20. The expandable medical device according to Claim 12, wherein the
2 elongated struts include a beneficial agent for delivery to a patient.

1 21. An expandable medical device comprising:
2 a plurality of elongated beams having a substantially constant beam cross
3 sectional area along a beam length;
4 a plurality of ductile hinges connecting the plurality of beams together in
5 a substantially cylindrical device which is expandable or compressible from a first
6 diameter to a second diameter by plastic deformation of the ductile hinges; and
7 a plurality of deflection limiting members positioned at a plurality of the
8 ductile hinges to limit the deflection at the ductile hinges.

1 22. The expandable medical device according to Claim 21, wherein the
2 deflection limiting members include angled side walls on opposite sides of a ductile
3 hinge which engage one another to limit deflection at ductile hinge.

1 23. The expandable medical device according to Claim 22, wherein the
2 deflection limiting members are V-shaped notches.

1 24. An expandable medical device which is visible in x-ray and fluoroscope
2 images, the device comprising:
3 a plurality of struts arranged to form an expandable cylindrical tube; and
4 a plurality of ductile hinges connecting the plurality of struts, wherein
5 the struts and ductile hinges have a thickness in a radial direction of the cylindrical tube
6 of at least 0.003 inches (0.0762 mm).

1 25. The expandable medical device according to Claim 24, wherein the
2 device is formed of stainless steel.

1 26. The expandable medical device according to Claim 24, wherein the
2 thickness of the struts and ductile hinges is at least 0.005 inches (0.127 mm).